



★ Word-addressable.

\$10K incl.
to one mini (more possible.)
Controller for
2311
2314

the Cybermation system 23
random access memory
controller



billion-bit
storage capacity
for the mini-computer

System 23

The Cybermation System 23 Random Access Memory (RAM) Controller is a compact solid-state unit that equips mini-computers for mass storage capability. It is a self-contained sub-system that permits direct communication between the processor and rotating-head bulk-data storage equipment such as the IBM 2311, 2314, or equivalent devices. On this basis it adds to the mini-computer's capability all the inherent advantages of disc memories — large storage capacity, millisecond access time, interchangeable packs that can be stored off line. In short, System 23 brings to modestly powered computers a level of memory usually found only in larger, more powerful, and far more expensive machines. It offers the additional advantage of permitting an interchange of memory packs in multiple computer systems (mixture of large and small processors), thus providing maximum system-to-system flexibility.

The System 23 Controller is basically a combination of interface and control logic, and is extremely simple in view of the operations it performs. One side of the system interfaces directly with the input/output facility of the computer; the other side contains the multiple-device electronics for interfacing with one or more disc drives. Both are plug compatible.



Between the interfaces is a concentrated network of control logic that provides for signal compatibility between processor and device, i.e., provides serial to parallel and parallel to serial data conversion. Other functions performed by the Controller are detailed on page 3.

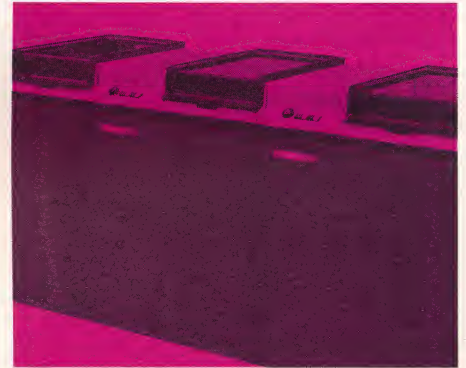
A single System 23 is capable of interfacing a computer with up to eight disc drives, and incorporates an overlapping process mode that permits a data transfer function to be performed on one drive while seek operations (positioning to a new track) are being executed on one or more of the other drives. The normal processing ability of the computer is not inhibited while these seeking and transfer operations are being carried out. On this basis the System 23 is considerably more than just an interface. It is a full input/output, processor/selector channel controller.

Perhaps the most significant characteristic of System 23 is that it accomplishes the entire interfacing and control function through stored micro-programmed logic and hardware. For example, all data servicing is under hardware control, as is the addition of cylinder and head position verification information to each sector block. Position identification is also checked by hardware prior to each read and following each seek, before a write is performed. A more detailed explanation of hardware-monitored operations is provided in the section entitled "status monitoring."

Foremost among System 23's performance characteristics is its ability to perform such sophisticated operations as data chaining, command chaining, data skip, and overflow read-write functions. Media compatibility with IBM System/360 information format can also be provided as an optional extra.

billion-bit storage

When used in the optimum condition the System 23 Controller can provide storage capacity for a mini-computer on the order of billions of bits. Assume, for example, a typical mini-computer interfaced with IBM storage devices. A single pack has a random access storage capacity of 5,580,000 bytes of useable data when prepared by the Controller on an IBM 2311 type file, and 22,320,000 bytes of useable data when prepared on an IBM 2314 type file. Expanding on the ability of a single Controller to access up to eight drives, and using the byte capacity of the 2314, it is possible for a single mini-computer to



be provided with a storage capacity of 1,428,480,000 bits. Based on a general price of \$10,000 for a single System 23 Controller, a storage cost of approximately .009 cents per bit is realized. When disc packs are removed and stored off line, there is virtually no limit on storage capacity and an even lower per bit cost is realized. The cost is also substantially reduced when Controllers are ordered in quantity.

micro-programmed logic

The System 23 Controller performs the greatest portion of its interfacing and memory accessing functions via hardware. This is accomplished through stored micro-programmed logic — or firmware — which is used to implement the micro-level control functions of seeking, searching, and data transfer. Control words are fetched through a direct memory access path to the CPU, and this forms the basis of the System 23's hardware control. The micro-programming concept is a key advantage since it permits the computer to go about its normal processing operations without wasting valuable compute time waiting for data to be retrieved from memory.

A second advantage of the firmware concept is found in elimination of many software requirements and conservation of valuable core space such software would normally occupy. With the Cybermation supplied firmware, considerable programming flexibility is provided with almost no software effort on the user's part. Only a nominal software input/output driver is needed for System 23 operation.

interface & logic functions



Directly plug compatible with the I/O facility of the processor, and contains the circuitry for adapting the Controller to the specific signals of a given mini-computer. Pre-engineered, modular-designed circuit cards permit matching the interface to the individual characteristics of a wide range of machines with the fastest possible turn-around time and at the lowest possible cost. A partial list of mini-computers that can be easily accommodated by the System 23 Controller is given on page 4.

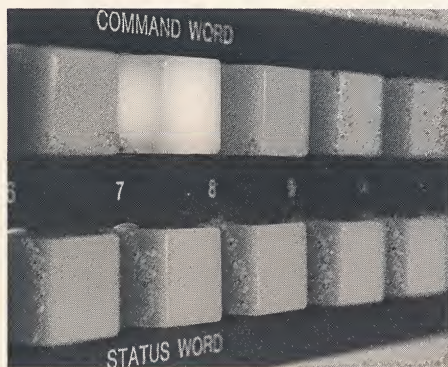
The primary portion of System 23 containing control logic circuitry that is neither processor nor device dependent, and is therefore furnished as standard in all Controller models. This standardization contributes substantially to the favorable economics of System 23. MSI techniques are used throughout the control logic network, which further contributes to reduced cost while conserving space requirements and improving reliability factors.

Contains the multiple-device electronics — packaged on interchangeable modules — for adapting the Controller to the particular data configuration of any given memory device. Circuitry is incorporated for interfacing with up to eight devices. Field changeable interface capability is provided with respect to IBM files, i.e., a System 23 Controller originally equipped to interface with the 2311 can be modified in the field to interface with the 2314, simply by exchanging modules.

status monitoring

System 23 provides for complete status monitoring through a number of built-in hardware checks and a panel-mounted display console. The display consists of two rows of pilot lights corresponding to COMMAND WORD and STATUS WORD functions, and facilitates software debugging and hardware trouble shooting by displaying the last control word issued. The only functional controls required are an ON-OFF power switch and a system reset switch mounted adjacent to the display.

Accuracy of transferred data is assured through a 16-bit cyclic check code word that is appended to each data block. The check word is a function of the data in the block, and on this basis it is automatically checked when data is read back to assure that no bits have been dropped and that no extraneous bits are picked up. Status bits are also reserved for cyclic check errors, to detect improper track positioning, incomplete seek operation, non-power conditions, and a variety of other potential malfunctions, the occurrence of which causes immediate termination of the command and the return of an interrupt to the processor. Write and erase currents are also continuously monitored to assure integrity at the time data is stored.



CPU/device adaptable

The control logic of System 23, which represents the major portion of the Controller, operates independently of both computer and memory device and is therefore fixed in its design. Other elements of the Controller — specifically the computer and device interfaces — are entirely dependent on the equipment to be interfaced and are therefore flexible in design. Data transfer buffering, for example, is dependent on the data configuration of the particular memory device used. Conversion of signals from the processor, on the other hand, is dependent on the particular computer used. With minimal modification — usually through pre-engineered modular-designed circuitry — System 23 can be made to operate between any typical mini-computer and the IBM 2311, 2314, or any equivalent file of other manufacture.

The following is intended only as a general guide to machines that can be readily interfaced via System 23. Inquiries regarding other computers and files are invited.

Typical mini-computers:

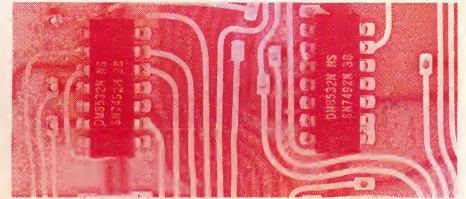
Data General Corporation,
Nova and Supernova
IBM, 1130
Selected Honeywell computers
Selected Digital Equipment
Corporation computers
Lockheed Electronics Company,
MAC-16
Varian, 520/i and 620/i

Typical storage devices:

IBM
Memorex
CDC
Century Data
ISS
Bryant
Peripherals General, Inc.

MSI packaging

The logic design of the System 23 Controller utilizes advanced MSI methods to conserve space and cost. Both TTL and DTL circuit techniques are employed for their inherent advantages of increased reliability, low power consumption, and reduced heat generation. Much of the interface circuitry in the system is hard wired rather than committed to printed circuit boards in order to maintain economical flexibility in adapting the Controller to the particular computer and memory device to be interfaced.



The Controller itself is a completely self-contained unit — including integral DC power supplies — intended for standard 19-inch rack mounting. With the exception of cables for connecting to the memory device and the I/O bus of the computer, no other hardware is required for its operation. System 23 may be installed remotely up to a maximum distance of 50 feet between CPU and the storage equipment.

specifications

The specifications provided here are based on interfacing a typical mini-computer with IBM files, and are intended only as a general guide to System 23 capability. Characteristics such as data capacity, transfer rate, and data block size will vary with computers and storage devices of differing manufacture.

Addressable Sectors: 40,000/disc pack
Transfer Rate: 2311, 156K bytes/second;
2314, 312K bytes/second

Actual Data Capacity: (above synchronization and error detecting bytes) up to 44.6 MB for 2311;
up to 178.5 MB for 2314

Data Block Size: 32K bytes, contiguous (transferrable with a single read or write command)

Control Word Length: compatible with computer I/O

Accuracy: (a) 16-bit cyclic check (code is appended to each data block); (b) write and erase current sensing is provided; (c) data written to the disc is checked for accuracy

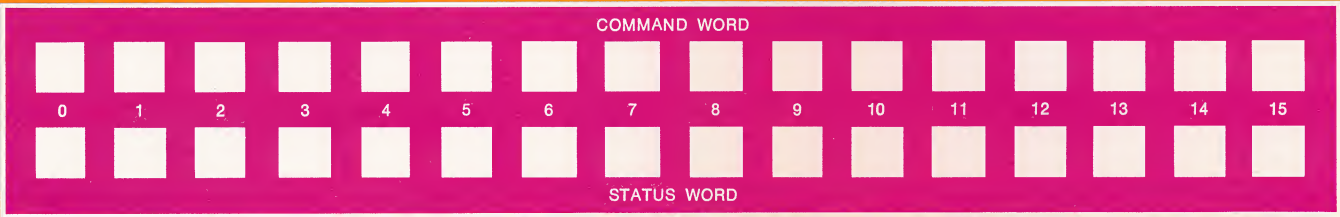
Power: 230 volts AC, single phase; current dependent on number of units to be powered

Dimensions: 19" wide, 7" high, 20" deep

Weight: 50 pounds (variable with number of discs to be powered)

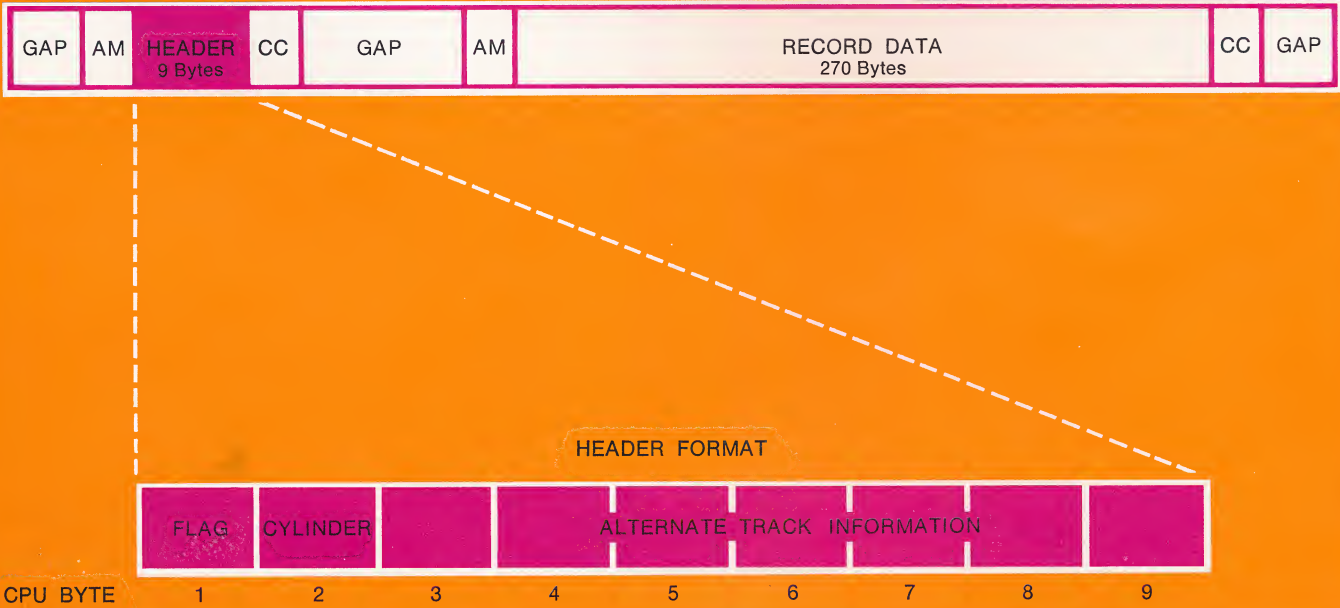
Ambient Temperature Range: 0° to 50°C, at 10% to 90% relative humidity

command & status functions



track sector format

IBM 2311 TYPE FILE — 10 SECTORS PER TRACK
 IBM 2314 TYPE FILE — 20 SECTORS PER TRACK



about Cybermation

Cybermation Incorporated is engaged in the design, development, and manufacture of systems-oriented product solutions to computer application problems. The recent acceptance of third-generation computers, and the explosive upsurge of the mini-computer, have created a computer application demand that is rapidly exceeding the total systems available to meet it. Providing specific products having a broad systems application is the answer to this demand, and the key objective of the Company. Although a relative newcomer to the field broadly classified as "computer peripherals," Cybermation has already made significant product contributions that have proved beneficial to both the computer mainframe manufacturer and the computer user. To assure



continuing, viable hardware solutions for its customers, the Company has pooled the talents of top people with diverse backgrounds relating to the computer environment. As a result, Cybermation is somewhat unique: a relatively young firm but one possessing a consid-

erable backlog of knowledge; a firm closely aligned with the computer but extremely diverse in its product development; an innovative company that has the ability to design for the future and produce for the present, simultaneously.

Inquiries regarding the products discussed in this bulletin, as well as those relating to other activities of the Company, should be directed to: Cybermation Incorporated, River Road, Washington Crossing, Pennsylvania 18977. Phone: (215) 493-3686.